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SCIENCE FOR POLICY BRIEF

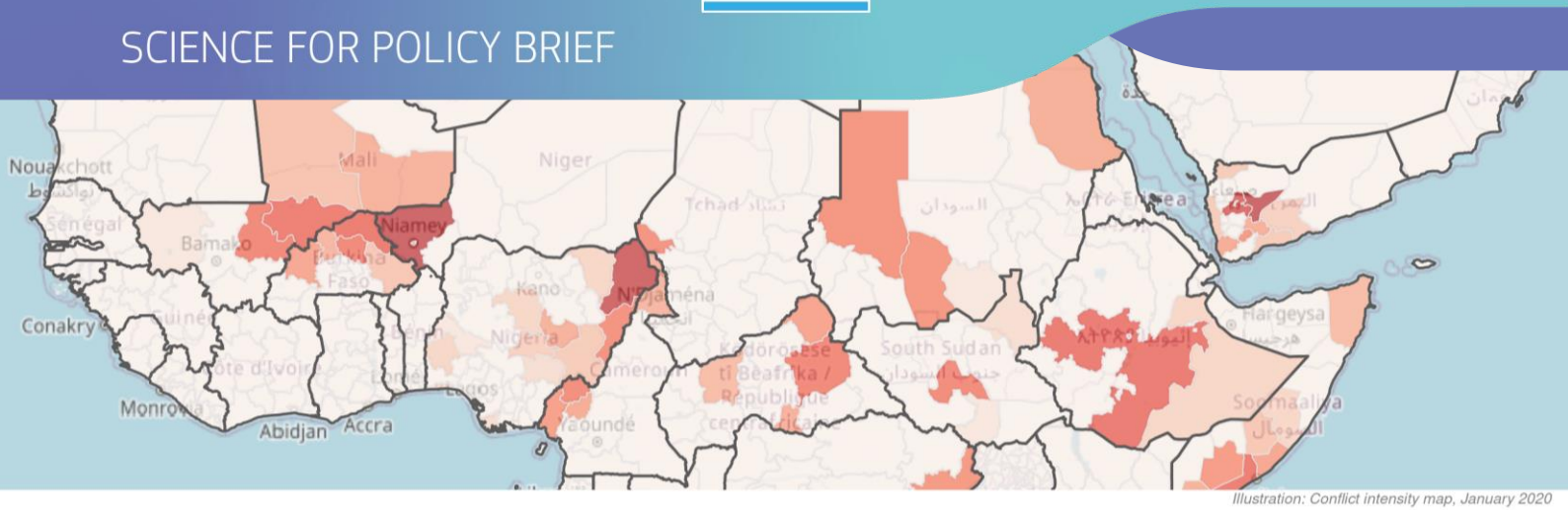


Illustration: Conflict intensity map, January 2020

A closer look at conflict risk: The Dynamic Conflict Risk Model (DCRM)

HIGHLIGHTS

→ The Dynamic Conflict Risk Model (DCRM) provides subnational conflict risk assessments with monthly updates and a time horizon of 6 months

→ The model covers over 2600 administrative areas in 140 countries across Africa, Asia, the Middle East, Eastern Europe, Latin America and the Caribbean.

→ The DCRM is being integrated into the EU's conflict early warning and analysis toolset, supporting country prioritisation, horizon scanning, and near-term risk monitoring.

→ Authorised users can access the monthly DCRM forecast through the Science4Peace portal: https://science4peace.jrc.ec.europa.eu/.

INTRODUCTION

Enhancing EU Conflict Early Warning

The European Union's Global Strategy and Strategic Compass emphasise the need for **robust conflict early warning systems**, recognising that **timely risk assessments** are essential for maintaining peace and stability. [1]

These strategic documents highlight the importance of data-driven conflict modelling to support informed decision-making and proactive responses to emerging security challenges.

The EU's conflict early warning approach relies on **evidence-based priority selection**, integrating quantitative conflict risk assessments from the Global Conflict Risk Index (GCRI) with qualitative assessments from the European External Action Service, notably geographical directorates, EU delegations and the Single Intelligence Analysis Capacity (SIAC). [2]

Joint Research Centre

Since 2015, the Global Conflict Risk Index (GCRI) has provided annual, country-level risk estimates to support conflict prevention efforts. The GCRI focuses on structural risk factors, such as democracy and demographics, which are important for understanding conflict risk but change gradually over time.

However, effective conflict prevention requires **assessing both long-term structural risks and short-term risks of escalation.** To complement the GCRI's annual assessments, the Joint Research Centre of the European Commission (JRC) has developed the **Dynamic Conflict Risk Model (DCRM).** The DCRM provides monthly updates of subnational risk scores for the next six months, offering more timely and granular insights into emerging risks.

The DCRM in a nutshell

Building on the GCRI, the DCRM provides short-term conflict risk assessments at the subnational level in 2,627 areas across 140 countries. The model estimates both the **likelihood of violent conflict and its potential intensity**, measured in battle-related fatalities.

The DCRM uses a similar modelling framework and relies on many of the same data sources as the GCRI, but operates at a finer geographic and temporal scale, with monthly updates instead of annual assessments. Figure 1 demonstrates how conflict can vary over time and space, highlighting the need for more fine-grained conflict risk models.

The model is **trained on monthly data from 1991 to the present**, using machine learning techniques (Random Forest and Gradient Boosted Trees) to identify patterns between risk factors and past conflicts. This allows it to produce risk estimates for the next 6 months based on the most recent data.

The DCRM currently includes up to 30 variables covering a wide range of risk factors, including an area's history of conflict, geography, demographics, and climate-related vulnerabilities such as exposure to droughts. These predictors include both country- and subnational-level variables, measured at yearly and monthly intervals, to capture both slow-moving structural risks and short-term fluctuations in conflict risk. Table 1 provides an overview of DCRM input variables.

Each month, the model assigns risk scores from 0 to 10 for overall **internal conflict risk** ("any conflict") and for three specific sub-categories: state-based conflict, non-state conflict, and one-sided violence.

Branching out: Tree-based learning

The DCRM uses tree-based learning algorithms, which split data into branches based on different combinations of risk factors.

By combining multiple **decision trees**, the model captures complex patterns in historical data, which it uses to assess future conflict risk.

Two types of tree-based models are used:

- **Random Forest:** A group of independent decision trees that "vote" on the final outcome.
- **Gradient Boosted Trees:** A sequence of trees where each learns from the errors of the previous trees, gradually improving accuracy.

Table 1: Overview of DCRM input variables

Dimension	Component	Variable
Security	Conflict history	Conflict fatalities (past 3-24 months), Conflict history, Time since last conflict
	Conflict dynamics	Conflict trend (past 6-12 months), Neighboring conflict
Political	Governance	Democracy index, State capacity, Corruption index, Political repression
Economic	Social inclusion	Women's empowerment
	Economic conditions	GDP per capita, Child mortality rate
Social	Ethnic diversity	Ethnic diversity, Cross-border ethnic ties, Ethnic inequality, Regional autonomy
Geography - Environment	Geography	Distance to capital, border, coast, Area size, Terrain ruggedness, Population density
	Climate	Drought index
Temporal Dynamics	Seasonality and Trends	Year, Month

Note: The selection of DCRM input variables will be continually reviewed and updated as new data sources become available.

DCRM use cases and applications

The DCRM is being integrated into the EU's conflict early warning and analysis efforts, with several current and planned applications.

The model serves as an additional source of information in the **annual country prioritisation** process and contributes to **the monthly horizon scanning** exercises at the European External Action Service (EEAS), which identifies countries at risk of deterioration over the next six months.

The model also provides detailed maps of near-term conflict risk to support **qualitative analyses** and **country briefs**, and aims to offer monthly updates on conflict dynamics in selected countries during the **monitoring and reporting stages** of the conflict early warning and analysis cycle.

Beyond these applications, the JRC is engaging with stakeholders to explore additional ways the model can support conflict prevention, crisis preparedness, and policy planning.

DCRM conflict categories

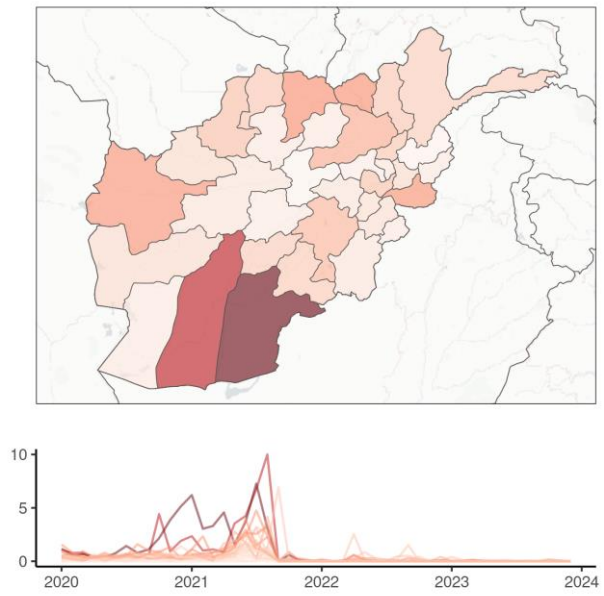
The DCRM provides an overall internal conflict risk score (**Any conflict**), which encompasses three sub-categories:

- **State-based conflict:** Armed conflict involving at least one state government.
- **Non-state conflict**: Armed conflict between non-state groups.
- **One-sided violence:** Direct, deliberate killing of civilians by a government or armed group.

These definitions follow the Uppsala Conflict Database Program (UCDP). [2]

The DCRM's main output is a **combined conflict risk score** (0 to 10). This score reflects both the likelihood and severity of conflict in a given area over the next six months and is updated monthly.

Figure 1 – Variation in conflict intensity across time and space in Afghanistan. The map shows total conflict intensity per area from 2020 to 2024, while the line chart presents monthly intensity scores over the same period.



Note: The figures shown in this brief use open-source historical data. Model results are not shown.

Future developments

The DCRM remains under **continuous development** to improve its accuracy, relevance, and user-friendliness. Ongoing efforts include testing additional data sources and predictor variables to enhance risk assessments, and evaluating alternative machine learning algorithms that could enhance performance.

The JRC also focuses on **tracking prediction "successes" and "failures"** and on making the model's predictions easier to explain and interpret. To keep the DCRM up to date and responsive to evolving conflict dynamics, the model is retrained on a yearly basis using the latest available data.

How to access the DCRM

Authorised users can access the monthly DCRM risk estimates through the **Science4Peace portal:** https://science4peace.jrc.ec.europa.eu/.

Access is restricted to staff from the European External Action Service (EEAS), the Service for Foreign Policy Instruments (FPI), the European Commission, other European institutions, and government offices of EU Member States that have an established cooperation with EEAS on conflict prevention, analysis, or crisis preparedness.

CONCLUSION

The Dynamic Conflict Risk Model (DCRM) enhances the EU's conflict early warning capabilities by complementing the Global Conflict Risk Index (GCRI) with more timely and detailed risk assessments.

As the EU aims to improve its early warning systems, the JRC's conflict forecasting efforts, including the DCRM, support the Union's goal of anticipating, preventing, and preparing for crises in line with the Preparedness Union Strategy.

References

[1] European External Action Service, "A Strategic Compass for Security and Defence," 2022. [Online]. Available: https://www.eeas.europa.eu/eeas/strategic-compass-security-and-defence-1_en. [Accessed 12 March 2025].

[2] European External Action Service - HR/VP, "JOINT STAFF WORKING DOCUMENT: Updated toolset for EU Conflict Analysis and Conflict Early Warning Objectives, processes and guidance.," 1 September 2023. [Online]. Available: https://data.consilium.europa.eu/doc/document/ST-12580-2023-INIT/en/pdf. [Accessed 12 March 2025].

[3] Uppsala Conflict Database Program, "https://ucdp.uu.se/," 2025. [Online]. Available: https://ucdp.uu.se/. [Accessed 12 March 2025].

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